

Daily Lesson Plan

Name: Dr. Patricia Vito Duncan Date: 10/23/10

Subject: Bottle Biology Topic: Ecosystems Grades: Adaptable for 7 through 12

Allocated Time: 70 – 90 minutes for explanation and construction, one to two weeks for observations and modifications, one to two months if seeds are used

Student Population: Variable: Heterogeneous or homogeneous grouping, advanced students, regular students, or students with accommodations

State Standards:

Specific Number: 3.1.12. A9; Exact wording: Identify questions and concepts that guide scientific investigations.

Specific Number: 3.1.12 .A9: Exact wording: Formulate and revise explanations and models using logic and evidence.

Specific Number: 4.1.10.F Exact wording: Know that both direct and indirect observations are used by scientists to study

the natural world and universe.

Specific Number: **3.4.8. D1:** Exact wording: Test and evaluate the solutions for a design problem.

Goal for Understanding: To engage in hands-on observation and investigation

Instructional Objective (Statement): By using plastic soft drink bottles, students will create a self- enclosed ecosystem model for which they will examine conditions and monitor the factors that keep the system alive.

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| Student Behaviors  Create a *Terraqua Column* or a *Ecocolumn,* following the steps for construction  Observe and record changes to components in the ecosystem  Modify factors to improve the quality of the ecosystem | Sources of Evidence  Completed Project  Observation Chart  Progress report for analyzing status of ecosystem and creating solutions to problems | Criteria for Evaluation  All components are included and assembled using accurate measurements to create the self-enclosed ecosystem (Rubric)  Completed Chart (Rubric)  Completed Report (Rubric) |

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| Estimated Time:  10 minutes  45 – 65 minutes  Times will vary  15 minutes | Teaching to the Objective  **Introduction/Motivation/**  **Prior Knowledge**  What concepts can you describe for the following terms? :  Photosynthesis, respiration, transpiration, hydrologic cycle decomposition, fermentation, adhesion, cohesion, biotic, abiotic, ecosystem, interaction, community, population, habitat and niche  Describe the purpose of *Bottle Biology* in connection with the concepts.  **Developmental Activities:**  What are some of the relationships that exist between organisms that exist in this area?  What factors affect the success of the survival of a species?  Explain that students will be constructing a *Terraqua Column* of an *Ecocolumn* from the *Bottle Biology* programto create a simple model that will provide an opportunity to engage in a hands-on activity to investigate the relationships between the abiotic and biotic components of an ecosystem. The dynamics that occur within the column in a bottle will allow students to apply what they discover to aspects in a complex world.  Descriptions of the projects are provided in the manual or on the website: <http://www.bottlebiology.org/> and are extensions of “**Do You Know Your Neighbors?”** an inventory and field study of local fauna. The *Terraqua Column* model is used to explore the link between land and water and has three basic elements to include soil, water and plants. This project can be used as a model of a selected local area. The *Ecocolumn* is used to construct a bottle habitat for some of the animals and plants located in an area in close proximity to the student’s residence or school.  Students will access materials from the Bottle Biology Tool Kit, and to include plastic 2-liter bottles, soil, water, assortment of plants, decayed leave matter and organisms (Ecocolumn). Instructions in hand-outs provided or through PPT presentations should be explained, reviewing each step for the **Building and Filling** processes.  Have students create a list of questions associated with how students can maintain an ecosystem.  What variables can be considered in the maintenance of the system?   * What plan can you devise for the care of the column? * What physicals factors must be considered to maintain the system?   What experiment can be developed to enhance investigation?  Students observe and monitor their projects for a pre-determined amount of time, charting the growing of plants. If experiments are planned and executed, students should report the progress of plant growth and quantitative and qualitative changes that occur within the system. Students create and complete an observation chart.  Students analyze the processes that occur in the system and identify factors that can be modified to promote an optimum environment for the flora and fauna living in the column.  What calculations must be made to determine the status of the ecosystem? What is right with the system? What is wrong with the system? What conditions can be altered to improve survival? Can the design be altered to improve the quality of the system? Students create and complete a progress chart.  Assessment: Did the student create the column according to the directions to complete its construction? Did the student make and record observations of the components of the column? Did the student monitor the status of the system and make changes to improve its quality to ensure optimum survival of the plants/animals? Rubrics will be completed for the construction, the observation and the monitoring of the systems students created  Closure: Students share their creations and discuss their experiences during the process of setting up, observing, investigating and monitoring their projects. | Differentiation:  Required for each Section.  Students can participate in a whole class discussion or choose five about which they write explanations.  Students can be grouped with others to provide collaboration that will optimize the investigation experience.  Additional time can be provided for those who need it to successfully complete the project.  Accelerated students can create their own versions of bottle ecosystems designs that will allow for increased investigation |

Follow-up:

* Students make presentations about the observations of and modifications to the projects, and suggestions for further study.
* Students can engage in the creation of other B*ottle Biology*projects based on their field of study to include: a Decomposition Column, a Kimchee Column, Soil Meditations Columns, or a Predator-Prey Column.
* Students can write a paper that connects what they have learned to what actually happens in ecosystems and environments throughout the world to include such themes as sustainability and effects of global warming, management practices and the effect of pollution on wildlife habitats.

Materials:

* The *Bottle Biology* book: Ingram, Mrill (2003). *Bottle Biology*, an instructional materials program from the University of Wisconsin-Madison. Dubuque, Iowa: Kendall/Hunt Publishing Company.
* Hand-outs or a PPT presentation for instructions on building and filling bottles that coincide with the type of columns that have been chosen to suit the curriculum.
* The Bottle Biology Tool Kit, 2-liter soft drink bottles
* Observation Charts, Report Charts

Resources:

* The *Bottle Biology* book: Ingram, Mrill (2003). *Bottle Biology*, an instructional materials program from the University of Wisconsin-Madison. Dubuque, Iowa: Kendall/Hunt Publishing Company.
* Websites:

<http://www.learner.org/courses/essential/life/bottlebio/ecocol/takinginventory.html>

<http://www.scienceteacherprogram.org/biology/Moulinos02.html>

RUBRICS

<http://bxscience.enschool.org/ourpages/auto/2009/9/11/43488311/Bottle%20Biology%20Lab%20Report%20Rubric%202009.pdf> (HIGH SCHOOL)

<http://www.clemson.edu/ipm/Curriculum_03preliminary.pdf> (MIDDLE SCHOOL**\***ALSO LESSON PLAN FOR EXTENSIONS OF BOTTLE BIOLOGY)

Technology:

* Use an Excel Spread Sheet or Tables to create observation and progress charts
* Use a PowerPoint to create a presentation of observations and modifications